

Multicast Connectivity Solution based on UDP Tunneling

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Connectivity Problems of AG (Multicast based)



Access Grid uses multicast for multimedia delivery

- An efficient method for many-to-many communication
- One copy of data to multiple receivers



Multicast-disabled networks

- Unicast networks
- Behind NAT & Firewalls



Multicast failures compromise the usability of the Access Grid

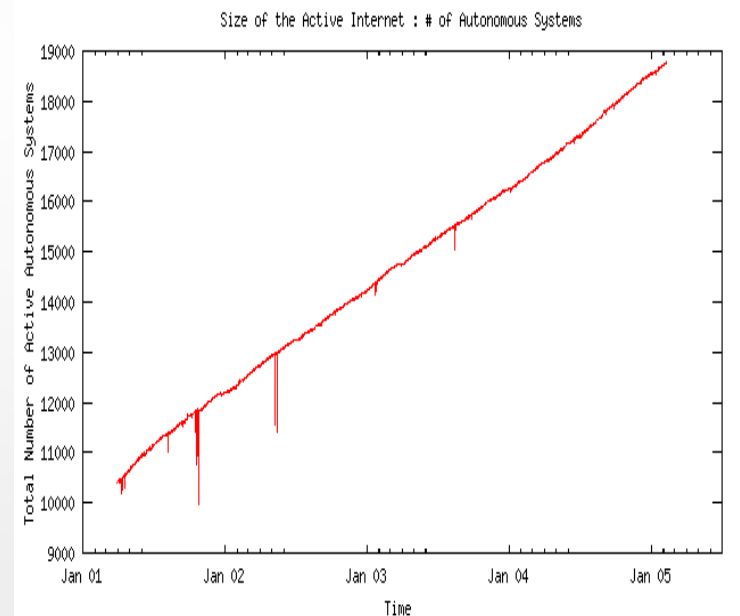
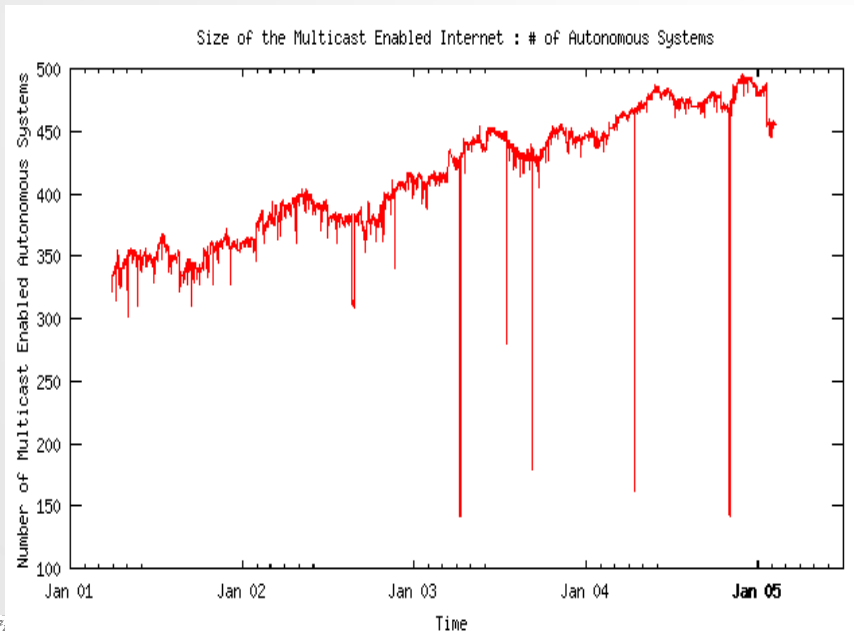
Unicast networks

IP multicast deployment status

- Less than 5% of the autonomous systems (AS) in the internet are multicast enabled at present

ISPs are reluctant to deploy IP multicast

- IP multicast is difficult to setup and administer



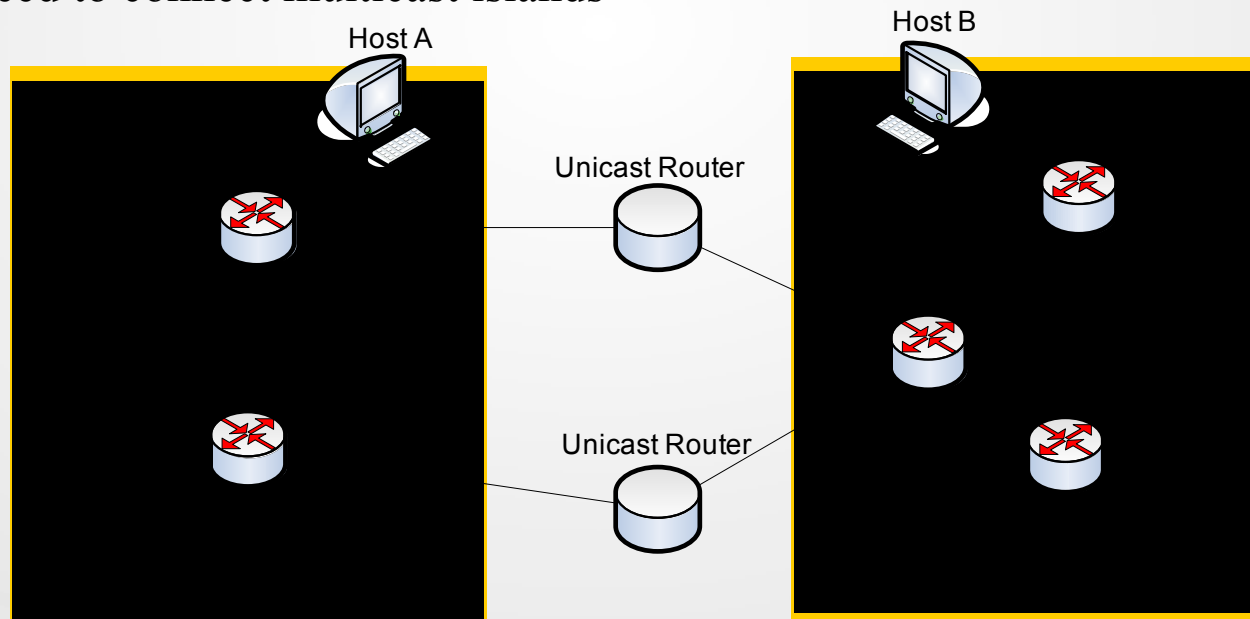
Multicast Islands

Multicast island

- IP multicast is enabled only in local domain
- Without connection with outer multicast network

Even if multicast is enabled

- Can not communicate with all multicast enabled users
- Need to connect multicast islands



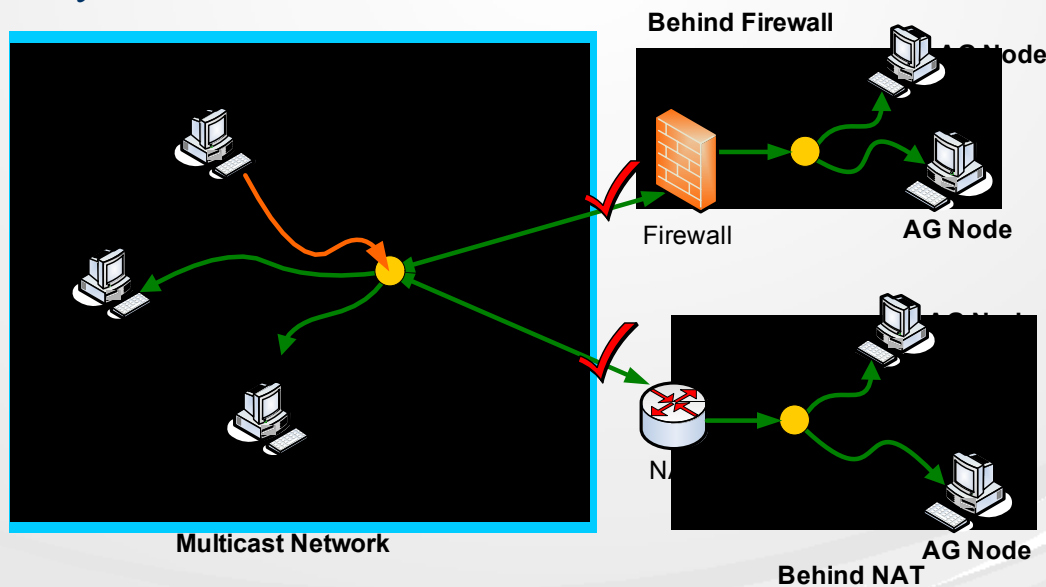
Firewall and NAT

Firewall

- Packet filtering and Protocol end point
- A multicast packet sent over the Internet will never be seen on the intranet, unless such packets are explicitly relayed by the firewall

NAT (Network Address Translation)

- Unidirectional connection initiation only
 - Only hosts behind NAT can initiate the connection



Existing Multicast Bridges

QuickBridge

- Forward traffic between multicast and unicast peers
 - Quick Bridge Server locates on multicast network
 - Receive and forward to each unicast peer
 - Automatic bridge creation for a venue

RCBridge

- Forward traffic between multicast and unicast peers
- Web-based source selection
 - Source selection based on SSRC
- Platform independent (written in Java)
- Users need to manually run multimedia applications

Existing Multicast Bridges (Cont.)

Disadvantage

- Scalability
 - Need to handle each unicast peer separately
 - As the number of unicast user increases, more bandwidth and system performance is needed
- Modification of AG Toolkit
 - Need additional space to store unicast address information
 - Application has to support both multicast and unicast
- Not applicable to users behind NAT and Firewall
- Application need to support both multicast and unicast

Required Improvements for Multicast Bridge

Scalability

- Performance and bandwidth efficient

Transparent to AG

- Multicast-only applications also can work

Traverse Firewall and NAT

- Use small number of open ports
- Connection request should go out from inside of multicast-disabled network

Reliability

- Support against system crash

AG Connector Goal

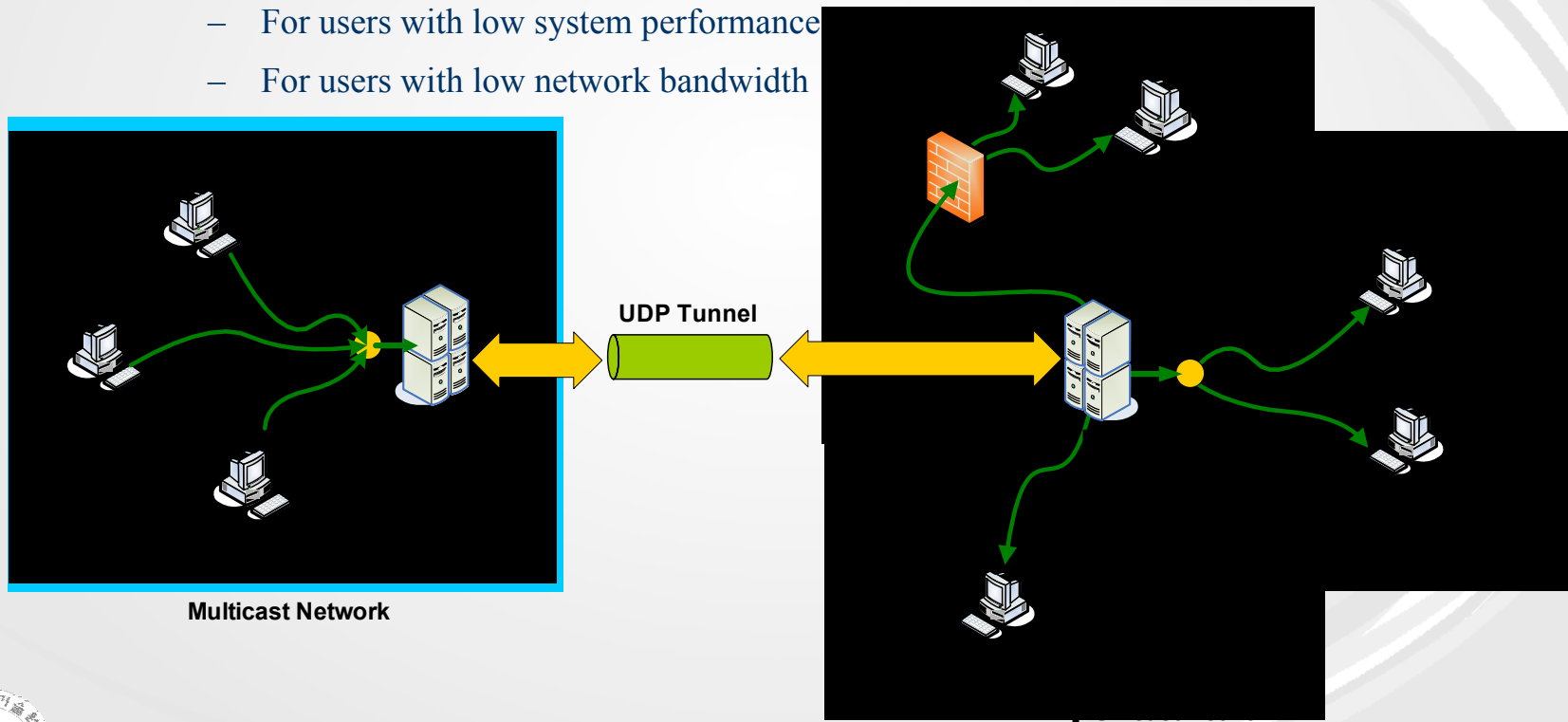
To provide improved multicast connectivity solutions to AG users under heterogeneous network environments so that they can better utilize the AG collaboration infrastructure.



AG Connector

Provide solution for all kinds of connectivity problems in AG

1. AG Connector for unicast peers
2. AG Connector for networks behind firewall or NAT
3. AG Connector as a proxy
 - For users with low system performance
 - For users with low network bandwidth

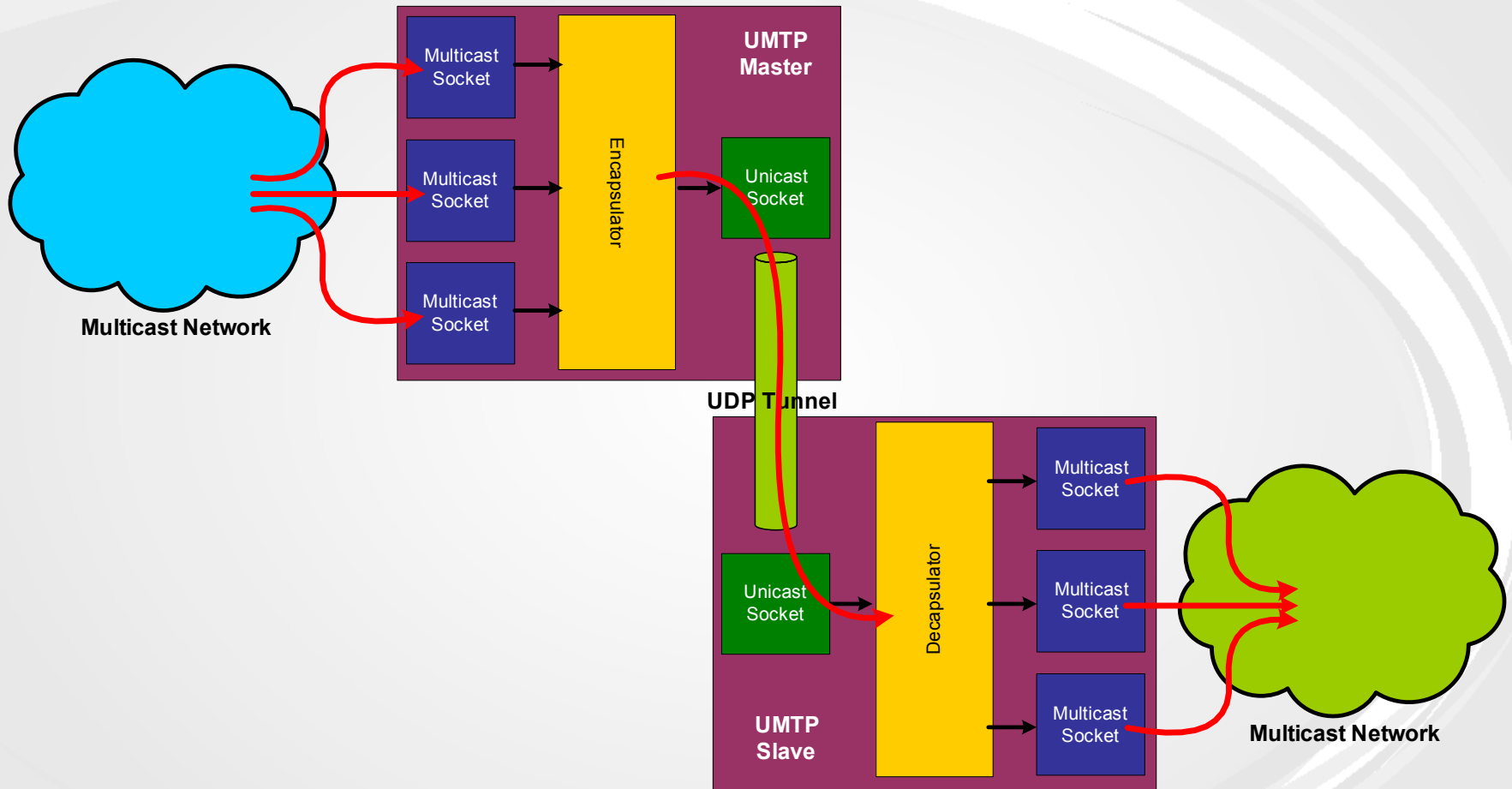


UMTP (UDP Multicast Tunneling Protocol)

- ❏ An application-level tunneling protocol
- ❏ UMTP operates using UDP datagram between pairs of nodes
 - Creates UDP tunnel between two nodes
 - Two tunnel endpoints are in separate networks without multicast connectivity
- ❏ Multicast data is encapsulated in UDP datagram packets
 - Each tunnel endpoint receives multicast data in its network
 - Encapsulated data is sent over the unicast UDP connection



UMTP (Cont.)



Why & How “UMTP for Multicast Bridge”

Better multicast accessibility to end users

- Scalable: Performance and bandwidth efficient
- Transparent to AG: Multicast-only applications also can work

Simplified port management by using encapsulation

- Uses single port number → Easily applicable to Firewall and NAT
- Connection request goes out from the inside of the network

Implementation Issues (How?)

- To connect with UMTP master
 - Tunnel endpoint should be aware of which group/port is used by AG media application; Does not need to allocate a new multicast address; Must know multicast address list in a venue

● Shared application

- Reliability: Provide a backup structure to cope with server crash

AG Connector Shared Application (Ver. 1)

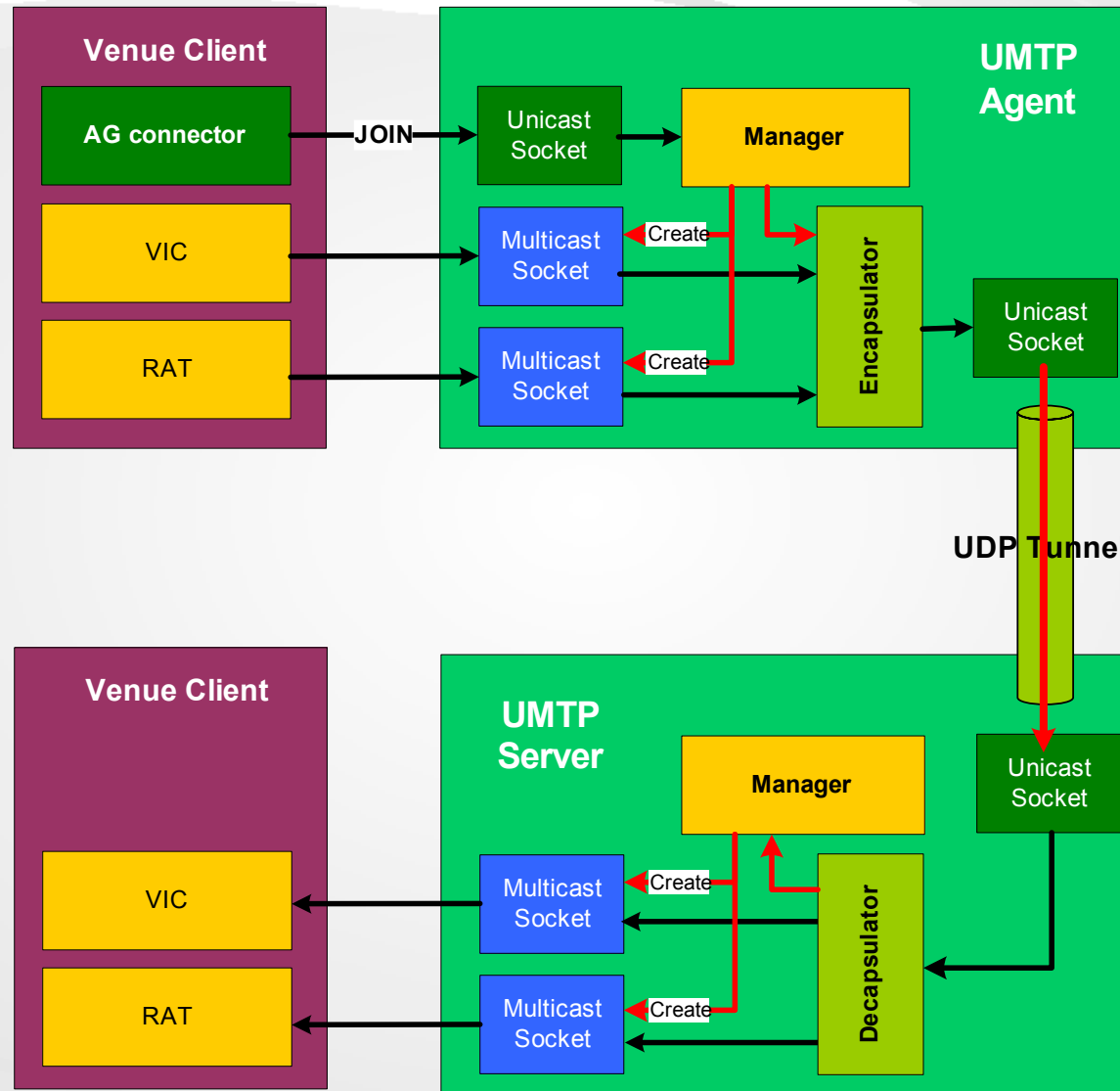
Multicast Bridge with UMTF as AG Shared Application

AG Connector: Shared
Application Contest

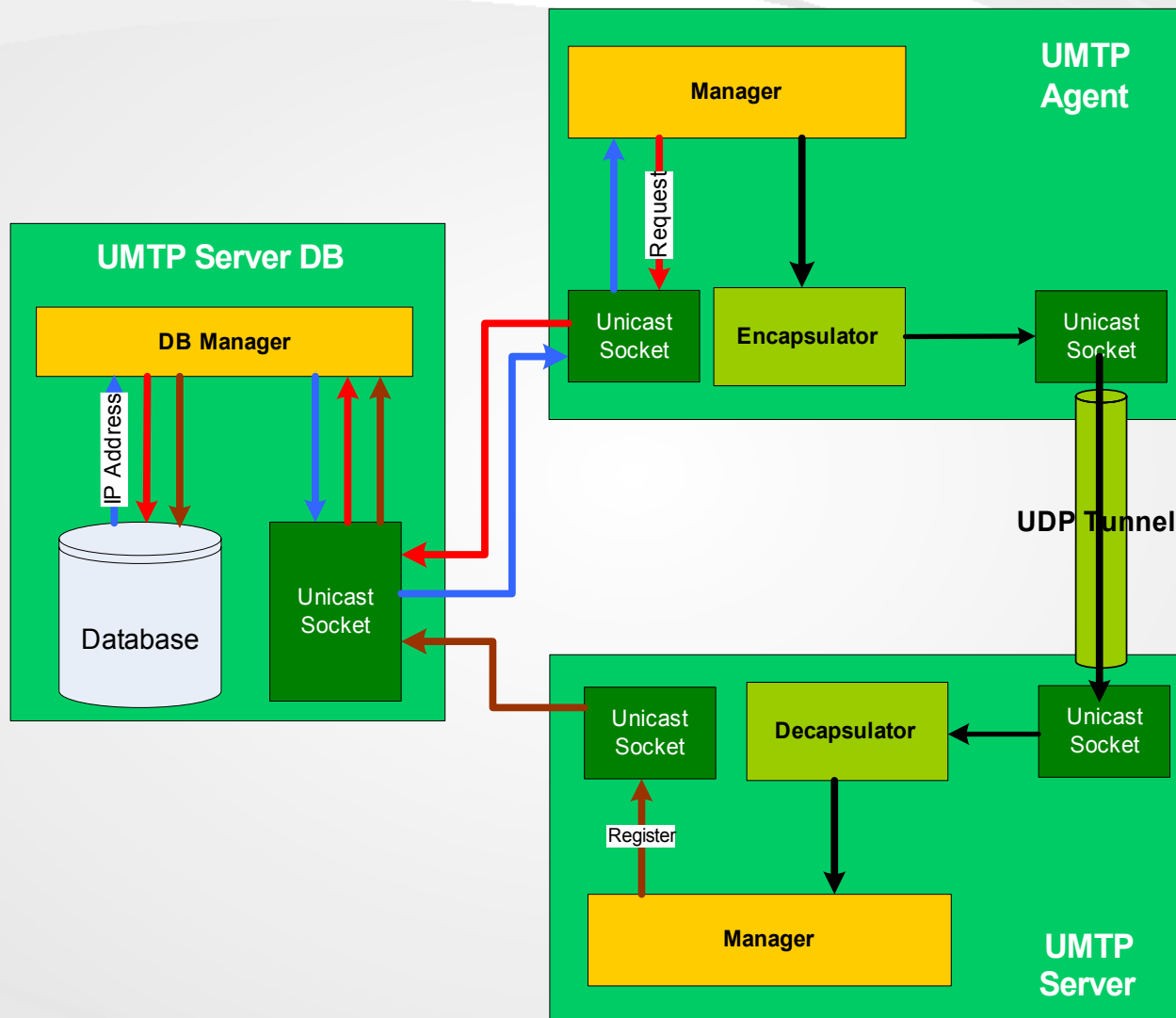
Components

- UMTF server
 - Implementation of UMTF slave
 - Locates in multicast network
- UMTF agent
 - Implementation of UMTF master
 - Request connection to UMTF server
- AG connector
 - Connection with UMTF master
- UMTF server database
 - Store list of UMTF Server
 - Let UMTF agent know UMTF Server

Integration with Access Grid



UMTP Server Database



Future Works

Add reliability?

- UMTF server database checks server crash and let UMTF agents move to other server

Connect to closest server?

- Find closest server by measuring delay between server

HTTP tunneling?

- Create tunnels with HTTP to traverse the firewall

One side multicast-unreachable problem?

- Path to send is different from the path to receive
- Can receive, but can not send
- Different from multicast loop avoidance